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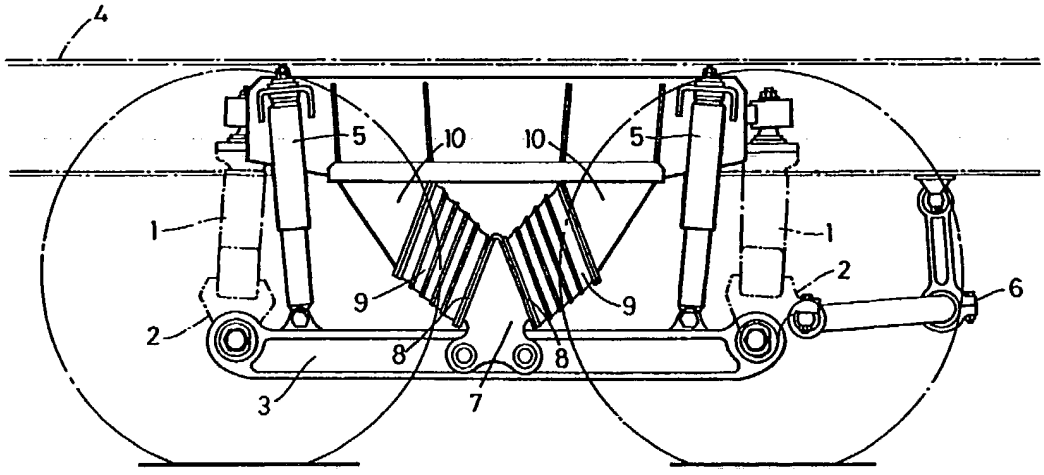
(56) Documents cited
GB 2241679 A **GB 2122148 A** **GB 2051704 A**
GB 2046680 A **GB 1251328 A**

(58) Field of search
UK CL (Edition K) **B7D DTM DTN**
INT CL[5] **B60G 5/02**

(54) **Vehicle suspension system**

(57) A tandem axle suspension system has a beam 3 connected between the axles to each side of the vehicle, a mounting block 7 rigidly secured to each beam and extending above the beam, and two rubber springs 9 secured in angular disposition to each mounting block and secured by their opposite ends to the load carrying platform 4, the angle of inclination of the springs of each pair being determined by the ground weight of the tandem axles to create a required natural or bounce frequency for the vehicle at its ground weight, and to so dispose the effective centre of rotation of the beam/spring assembly in proximity to the plane of the beam-to-axle connections as to ensure minimal weight transfer from one axle to the other during acceleration and braking.



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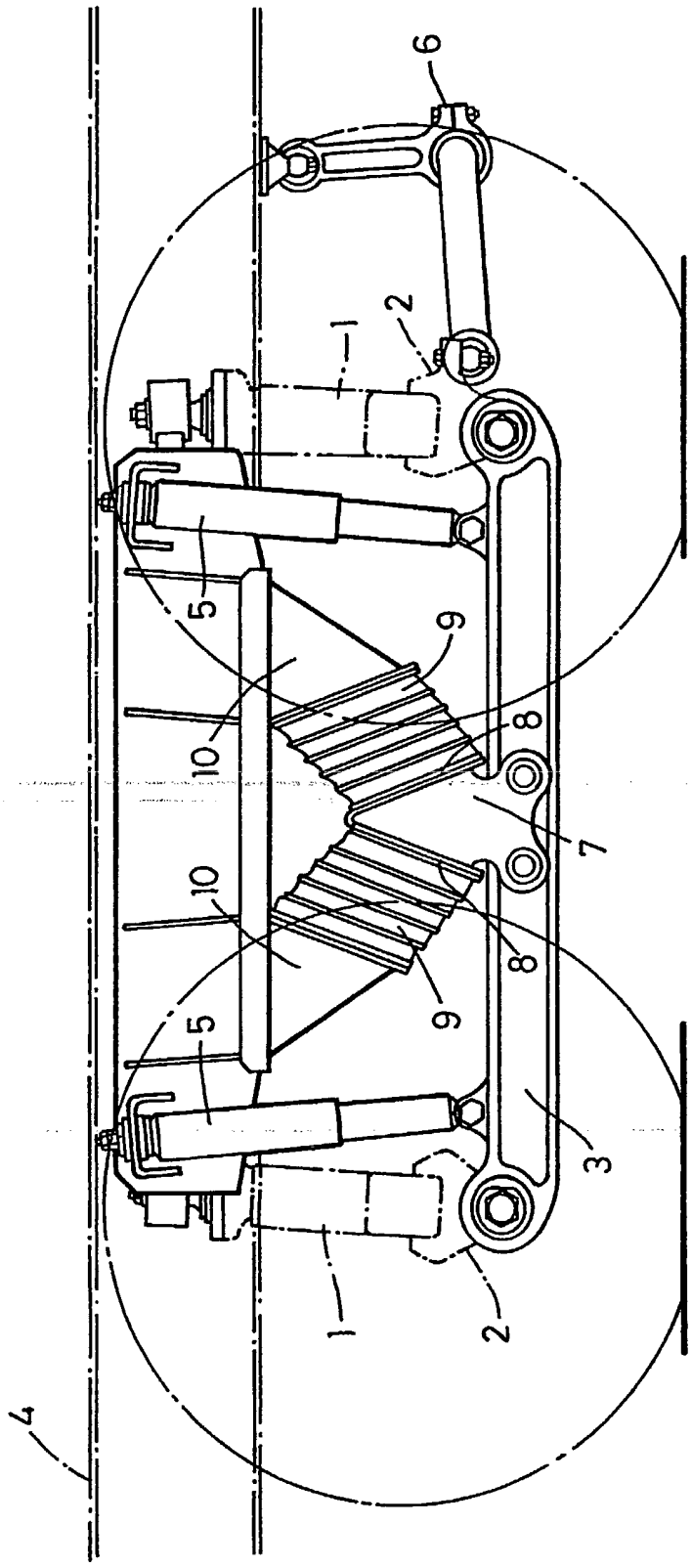
At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.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VEHICLE SUSPENSION SYSTEM

This invention relates to vehicle suspension systems, and is particularly concerned with tandem axle vehicles.

Proposed legislation is such that with load carrying vehicles of both cab and fixed platform or tractor and articulated trailer types, the springs of the suspension system must exhibit a particular natural or bounce frequency to suit the intended ground weight of a particular vehicle such as, for example, less than 2Hz with the vehicle and load having a 19 tonne ground weight.

With conventional leaf springs, this is only achievable with springs having a considerable number of leaves, adding considerably to the cost and weight of a vehicle or a trailer at the expense of its load carrying capacity, it being the combined vehicle weight and load that must be below legislated levels before the vehicle can be used legally on public highways.

A most effective alternative to leaf spring suspensions is the so called rubber suspension of the type described in British Patent 1276352 where rubber blocks are secured to a mounting block pivotally mounted within a beam connected between the axles. The pivotal connection of the mounting block to the beam necessitates the location of the block within the beam to ensure that the line of action and hence load applied to the springs is generally central of the faces of the block to which the springs are secured, to prevent excessive bending moments from being induced in the springs and to prevent weight transfer from one axle to the

other when accelerating or braking. Consequently the beams of the suspension system are relatively bulky and relatively heavy again at the expense of vehicle load.

The invention has for its objective to provide a modified version of rubber suspension system capable of meeting the proposed spring frequencies for particular vehicle ground weights, with better weight characteristics and lower cost factors.

According to the present invention, a vehicle suspension system comprises a beam connected between the axles to each side of the vehicle, a mounting block rigidly secured to each beam and extending above the beam, two rubber springs secured to each mounting block and angularly disposed and secured by their opposite ends to the load carrying platform, the angle of inclination of the springs being such that the effective centre of rotation of the beam/spring assembly is the plane of the beam to axle connections. Preferably, there are anti-roll means connected between the suspension system or axle and the vehicle frame.

With the construction of the invention, a relatively simple I-section beam can be employed combining relatively high strength and low weight, the rigid connection of the mounting block on the beam and the angular disposition of the springs combining to ensure that there is minimal weight transfer from one axle to the other during acceleration and braking, and at the same time enabling the springs to combine to serve as a pivot allowing axle articulation.

According to a further feature of the invention, a

vehicle comprises a tandem axle suspension system having a beam connected between the axles to each side of the vehicle, a mounting block rigidly secured to each beam and extending above the beam, and two rubber springs secured in angular disposition to each mounting block and secured by their opposite ends to the load carrying platform, the angle of inclination of the springs of each pair being determined by the ground weight of the tandem axles to create a required natural or bounce frequency for the tandem axles at their ground weight, and to so dispose the effective centre of rotation of the beam/spring assembly in proximity to the plane of the beam-to-axle connections as to ensure minimal weight transfer from one axle to the other during acceleration and braking.

Thus, the invention permits considerable latitude in design in enabling the provision of any natural or bounce frequency for a given ground weight in a construction that combines relatively low cost, and relatively low weight with consequent enhanced load carrying capacity, and with minimal load transfer between axles. Thus, and for example, to ensure a natural or bounce frequency of 2Hz or less with a ground weight of 19 tonne, the springs should be set such that their longitudinal axes are at an included angle of 40^{o} - 45^{o}, and to provide a natural or bounce frequency of 2.3Hz for a ground weight of 26 tonne, the included angle should be 55^{o} to 60^{o}.

One embodiment of the invention is illustrated in the accompanying drawing, a schematic side elevation of a

suspension system.

In the drawing, a tandem axle suspension system has axles located in axle housings 1 and to which hanger brackets 2 are secured and to each of which a beam 3 is attached. Each axle housing 1 extends to and is suitably secured to, the load carrying platform 4 of the vehicle. Also attached between the beam 3 and the vehicle platform 4 are shock absorbers 5 and at one end an articulated anti-roll assembly 6 extends between the hanger bracket 2 to that side and the load carrying platform 4.

Centrally of the beam 3, a mounting block 7 is rigidly secured to the beam having angled mounting faces 8 to receive, and to which are appropriately secured, rubber springs 9, the opposite ends of which are attached to brackets 10 depending from the load carrying platform 4.

The angular disposition of the springs 9 is determined first in relation to the ground weight of the tandem axles and to generate a required natural or bounce frequency. Thus, and for example, for a ground weight of 19 tonne, and to generate a natural or bounce frequency of 1.9Hz the springs are to be set at an included angle of 40^{o} to 45^{o}. For a ground weight of 26 tonne, and to generate a natural or bounce frequency of 2.3Hz, the springs are set at an included angle of between 55^{o} and 60^{o}. The second consideration in setting the angular disposition of the springs is to put the centre of rotation of beam/spring assembly in the plane of the beam-to-axle connections, or in close proximity thereto and whereby to ensure minimal weight transfer from one axle to the other

during acceleration or braking, but without inhibiting the ability of the assembly to serve as a pivot allowing axle articulation.

CLAIMS

1. A vehicle suspension system comprising a beam connected between the axles to each side of the vehicle, a mounting block rigidly secured to each beam and extending above the beam, two rubber springs secured to each mounting block and angularly disposed and secured by their opposite ends to the load carrying platform, the angle of inclination of the springs being such that the effective centre of rotation of the beam/spring assembly is the plane of the beam to axle connections.

2. A vehicle suspension system as in Claim 1, wherein the beam is an I-section beam to which a mounting block is rigidly secured.

3. A vehicle suspension system as in Claim 1 or Claim 2, wherein an anti-roll assembly is connected between one end of the suspension system and the vehicle frame.

4. A vehicle comprising a tandem axle suspension system having a beam connected between the axles to each side of the vehicle, a mounting block rigidly secured to each beam and extending above the beam, and two rubber springs secured in angular disposition to each mounting block and secured by their opposite ends to the load carying platform, the angle of inclination of the springs of each pair being determined by the ground weight of the tandem axles to create a required natural or bounce frequency for the axles at their ground weight, and to so dispose the effective centre of rotation of the beam/spring assembly in proximity to the plane of the beam-to-axle connections as to ensure minimal weight transfer

from one axle to the other during acceleration and braking.

5. A vehicle as in Claim 4, wherein for a tandem axle assembly having a ground weight of 19 tonne, and to provide a natural or bounce frequency of less than 2Hz, the springs are angularly disposed at an included angle of 40^{o} to 45^{o}.

6. A vehicle as in Claim 4, wherein for a tandem axle assembly having a ground weight of 26 tonne and to provide a natural or bounce frequency of 2.3Hz, the springs are angularly disposed at an included angle of 55^{o} to 60^{o}.

7. A tandem axle vehicle suspension system substantially as hereinbefore described with reference to the accompanying drawings.

Patents Act 1977 -8-
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
9206036.7

Relevant Technical fields

(i) UK Cl (Edition K) B7D (DTM, DTN)

(ii) Int CL (Edition 5) B60G 5/02

Search Examiner
COLIN THOMPSON

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search
16 JUNE 1992

Documents considered relevant following a search in respect of claims 1-7

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X;P	GB 2241679 A (NORDE SUSPENSIONS LTD) See figure 1	1,3,4,5
X	GB 2122148 A (NORDE SUSPENSIONS LTD) Whole document relevant	1,3,4
X	GB 2051704 A (DUNLOP LTD) Whole document relevant	1,4
X	GB 2046680 A (FODENS LTD) Whole document relevant	1,3,4
X	GB 1251328 (METALASTIK LTD) See figure 6	1,4

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Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).

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